CH2M HILL
2485 Natomas Park Drive
Suite 600
Sacramento, CA
95833-2937
Tel 916.920.0300
Fax 916.920.8463

CH2MHILL

March 19, 2002

Ms. Kristy Chew
Siting Project Manager
California Energy Commission
1516 Ninth Street, MS-15
Sacramento, CA 95814

RE: Data Responses, Set 2C
Cosumnes Power Plant (01-AFC-19)

On behalf of the Sacramento Municipal Utility District, please find attached 12 copies and one original of the Data Responses, Set 2C, in response to Staff's Data Requests dated January 4, 2002.

Please call me if you have any questions.

Sincerely,

CH2M HILL

John L. Carrier, J.D.
Principal Project Manager

c: Colin Taylor/SMUD
Kevin Hudson/SMUD
Steve Cohn/SMUD

COSUMNES POWER PLANT (01-AFC-19)

DATA RESPONSE, SET 1G

(Responses to Data Requests: 16, 22, 29, 30, 31, 50, 51, 56, 87, 88, 143, 144, 145, and 146)

Submitted by

SACRAMENTO MUNICIPAL UTILITY DISTRICT (SMUD)

March 19, 2002

CH2MHILL

2485 Natomas Park Drive, Suite 600
Sacramento, California 95833-2937

Technical Area: Biological Resources
CEC Authors: Melinda Dorin and Rick York
CPP Author: EJ Koford and Debra Crowe

BACKGROUND

A proposed table of contents of the Biological Resources Mitigation Implementation and Monitoring Plan (BRMIMP) is supplied in Appendix 8.2D. In the proposed outline Section 4.4, Wetland Protections, there are subsections that do not correspond to that heading, i.e. Sections 4.4.6 through 4.4.8.

DATA REQUEST

16. Please provide a draft BRMIMP with the following additional sections and include any information in the sections such as impact avoidance measures and proposed mitigation where appropriate.

    - Regional Setting describing all habitats that may be impacted;
    - Biological Resources to be impacted (by species);
    - Construction schedule;
    - Under the existing heading for Mitigation Measures for Sensitive Biological Resources, include subsections that address the proposed species specific mitigation and avoidance measures, for species such as (but not limited to) Swainson's hawks, Western burrowing owls, and anadramous fish species.

    - Habitat compensation measures to mitigate for habitat loss;
    - Move the Habitat Revegetation Plan (4.4.8) to a separate section;
    - Add a section for pre-construction and post-construction aerial photos of the project area at a 1" to 100' scale; and
    - Agency agreements and permits.

    Response: A preliminary draft BRMIMP is presented as Attachment BR-16.

BACKGROUND

Table 8.2-4 summarizes the permanent and temporary project impacts to biological resources at the site. On AFC page 8.2-14 it states that the proposed 20-acre construction laydown area on the south side of Clay Station East Road has not been evaluated for the potential presence of vernal pools and special-status species. In the AFC the proposed construction laydown area is considered to have a temporary impact.

DATA REQUESTS

22. Provide a draft of the laydown area restoration and revegetation plan.

Response: Reference materials on revegetation offered by staff at the January 24, 2002 workshop were received March 7, 2002. A preliminary draft restoration and revegetation plan will be provided on March 28, 2002.

BACKGROUND

On page 8.2-7, in the special-status animals subsection, the AFC states that CNDDB records indicate that the valley elderberry longhorn beetle (VELB) (state- and federally-threatened species) is likely to occur along the Cosumnes River and other rivers that the proposed gas pipeline may cross. However, the AFC does not contain VELB field survey results.

DATA REQUEST

29. If VELB surveys were conducted for the project site and all project linears, then please provide the survey results (field survey dates, names and qualifications of biologists, transect spacing, locations and size of elderberry shrubs). If VELB surveys were not conducted, then conduct the appropriate (USFWS protocol) surveys and provide the survey results.

    Response: Field surveys for the VELB are being done along with the wetland delineation and should be available by March 29, 2002.

BACKGROUND

AFC Section 8.2.4.2 (page 8.2-10), states that although California tiger salamanders have been recorded within a mile of the site, none were observed. The AFC also states if any are disturbed within the project site or along the linear facilities, then it would be an insignificant portion of the population. However, the AFC does not contain California tiger salamander field survey results.

DATA REQUEST

30. If California tiger salamander surveys were conducted for the project site and all project linears, then please provide the survey results (field survey dates, names and qualifications of biologists, transect spacing, locations and size of elderberry shrubs). If California tiger salamander surveys were not conducted, then conduct the appropriate (DFG protocol) surveys and provide the survey results.

    Response: Based on the results of the wetland delineation and consultation with CDFG, areas will be identified for additional surveys for tiger salamanders. The CDFG protocol recommends that first surveys occur between March 15 and April 15, and second surveys occur between April 15 and May 15. Therefore, survey results will be provided by May 31, 2002.

BACKGROUND

In AFC Section 8.2.3.3, (page 8.2-7), it states that western burrowing owls often use ground squirrel burrows along railroad tracks and road cuts and that burrowing owls are likely to occur along the railroad tracks west of Franklin Boulevard and along Twin Cities Road. It also states that none were seen on or adjacent to the project site. However, the AFC does not contain western burrowing owl field survey results.

DATA REQUEST

31. If California tiger salamander [burrowing owl] surveys were conducted for the project site and all project linears, then please provide the survey results (field survey dates, names and qualifications of biologists, transect spacing, locations and size of elderberry shrubs). If California tiger salamander [burrowing owl] surveys were not conducted, then conduct the appropriate (DFG protocol) surveys and provide the survey results.

    Response: Field surveys for burrowing owls are being done along with the wetland delineation and should be available by March 29, 2002.

INSERT

Attachment BR-16, Preliminary Draft BRMIMP

Technical Area: Cultural Resources
CEC Author: Judy McKeehan
CPP Author: John Carrier

BACKGROUND

The discussion of cumulative impacts in the AFC does not provide any information on other projects in the area that could impact cultural resources. The discussion of cumulative impacts should consider such other projects. Additional information is needed to complete the staff analysis.

DATA REQUEST

50. Please provide a discussion of other projects (in permitting or currently under construction) within a one-mile radius of the Cosumnes Power Plant project.

    Response: Other projects within 1-mile are provided in Attachment LU-56.

51. Please provide a discussion of the cumulative impacts relevant to the information from the previous question.

    Response: Figures LU-56a to 56c were compared to the CHRIS maps in our possession. For LU-56a and LU-56b; there are no known recorded cultural resources; so, none of these projects would affect cultural resources and there would be no cumulative impacts. For LU-56c, the CHRIS maps we have do not "cover" these parcels, or cover them only partially. Where we do have coverage, there are no known recorded cultural resources. Since the storage of biosolids (which we assume is hay or alfalfa since cattle is grazed in this area) is surface storage, this activity would not create a cumulative impact to cultural resources.

Technical Area: Land Use
CEC Author: James Adams
CPP Author: Katy Carrasco

BACKGROUND

AFC Section 8.4.6, Cumulative Impacts, discusses the potential cumulative land use impacts that would result from the proposed project. The AFC discusses existing land uses in the vicinity of the proposed project, but does not identify existing or proposed projects along the proposed linear facility corridor.

DATA REQUEST

56. Please provide a map that shows the location of all cumulative projects identified including future projects along the proposed linear facility corridor (i.e., natural gas transmission line, and water line). This should also include projects that have been proposed since June 2001.

    Response: As discussed at the January 24, 2002 workshop, we received from Rob Burness a list of projects approved by Sacramento County in the vicinity of the gas line route. The fax from Mr. Burness is provided as Attachment LU-56. Three of the parcels that he lists are more than 500 feet from the gas line. They are: 119-1220-079 (item 7); 119-145-02 (item 9); and 119-133-06 (item 11). The location of the other parcels and proposed use is presented in Figures LU-56a to 56c.

Attachment LU-56

List of Recent Projects Along the Gas Line Corridor

COUNTY OF SACRAMENTO
PLANNING AND COMMUNITY DEVELOPMENT DEPARTMENT

827 SEVENTH STREET, ROOM 230
SACRAMENTO, CALIFORNIA 95814
Telephone: (916) 874-6141
Fax: (916) 874-6400

THOMAS W. HUTCHINGS
DIRECTOR

Robert Sherry, Principal Planner
Long Range Planning & Enforcement

Tricia Stevens, Principal Planner
Application Processing

Ana Rhodes, ASO III
Administration

FAX COVER SHEET

TO: Katie Carrasco FROM: Bob Burrows

PHONE NUMBER: PHONE NUMBER: 874-6141

FAX NUMBER: 614-3553 FAX NUMBER: (916) 874-7499

NUMBER OF PAGES SENT (INCLUDING COVER SHEET): 3

ORIGINAL WILL FOLLOW: ____

ORIGINAL WILL NOT FOLLOW: X

MESSAGE/COMMENTS:

THIS FAX WAS TRANSMITTED BY: RCB

RECENT PROJECTS W/IN 500' SMUD PIPELINE & 1MI OF PLANT

Reference Number	Control Number	APN	Date Approved	Proposed Use
1.	96-UPB-0576	140-0030-014,015 140-0050-021 138-006-028	06/11/97	Biosolids Storage
2.	99-PMR-0100	138-0090-020	09-25-00	Buzdas property—create two lots
3.	00-UPZ-0390	138-0090-060	08-30-00	Residential accessory dwelling
4.				
5.				
6.	01-PAM-0579 01-UPZ-0721	132-0140-006		Leonard—accessory dwelling use permit pending
7.	01-PAP-EXP-0668	119-120-079		Lakepoint Apartments -- pending
8.	98-CZB-0425 (ZMA 5330)	119-0161-016	01/27/99	Park rezone to "O" zone
9.	98-XSP-0006	119-143-29/145-02	08/26/98	JDS Laguna Sub. Extension of Time Recorded 09/21/01 Laguna Estates
10.	97-UPZ-0569	119-0120-062	12/31/97	RV and Boat storage use permit

11.	00-XSP-0246	119-133-06		Harris ranch #1 – now City of Elk Grove recorded subdivision 04/04/2000

Research for SMUD Power Plant

Estimate of Time for Project

15.25 hours

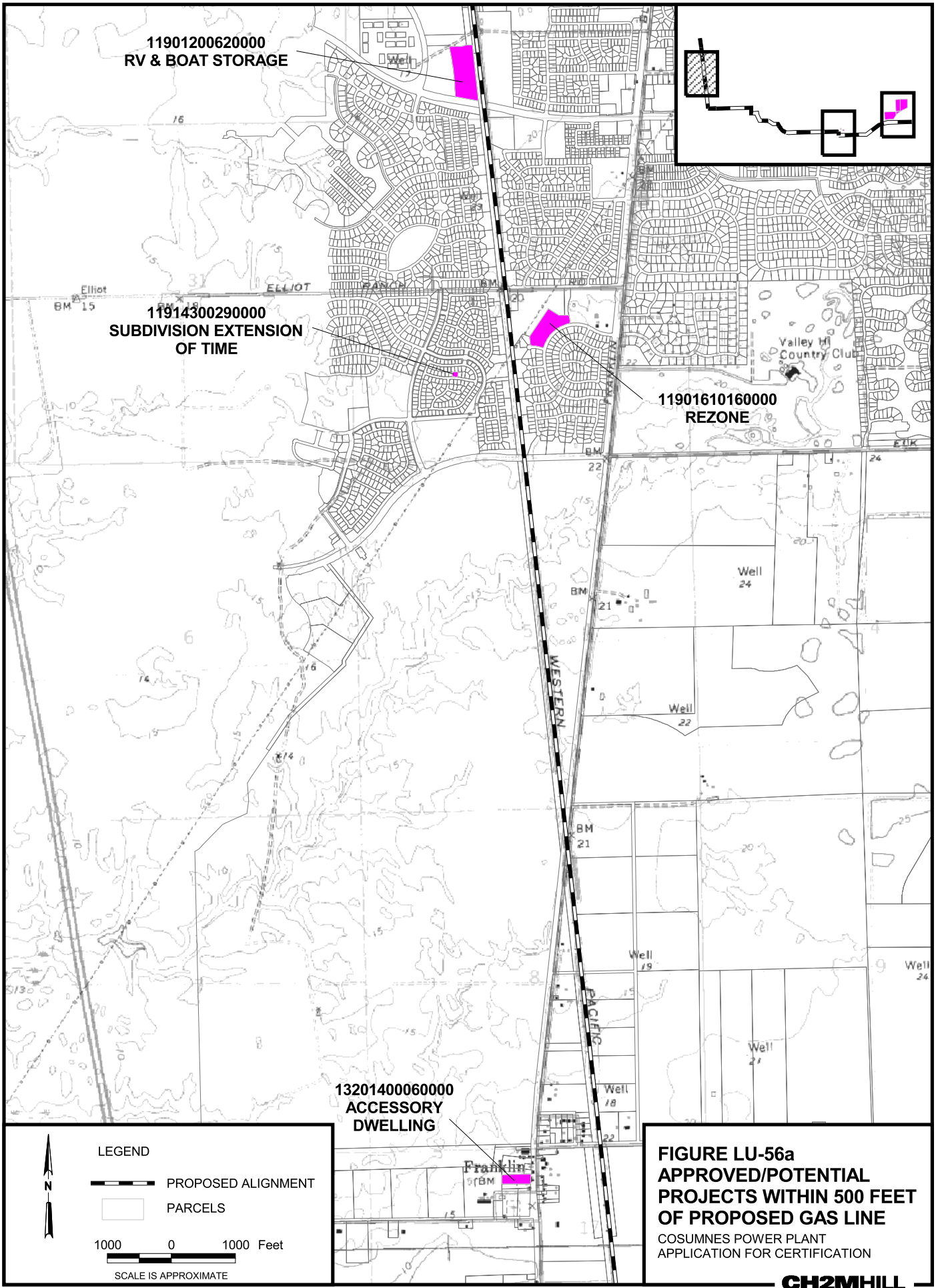

FIGURE LU-56a
APPROVED/POTENTIAL PROJECTS WITHIN 500 FEET OF PROPOSED GAS LINE
COSUMNES POWER PLANT
APPLICATION FOR CERTIFICATION

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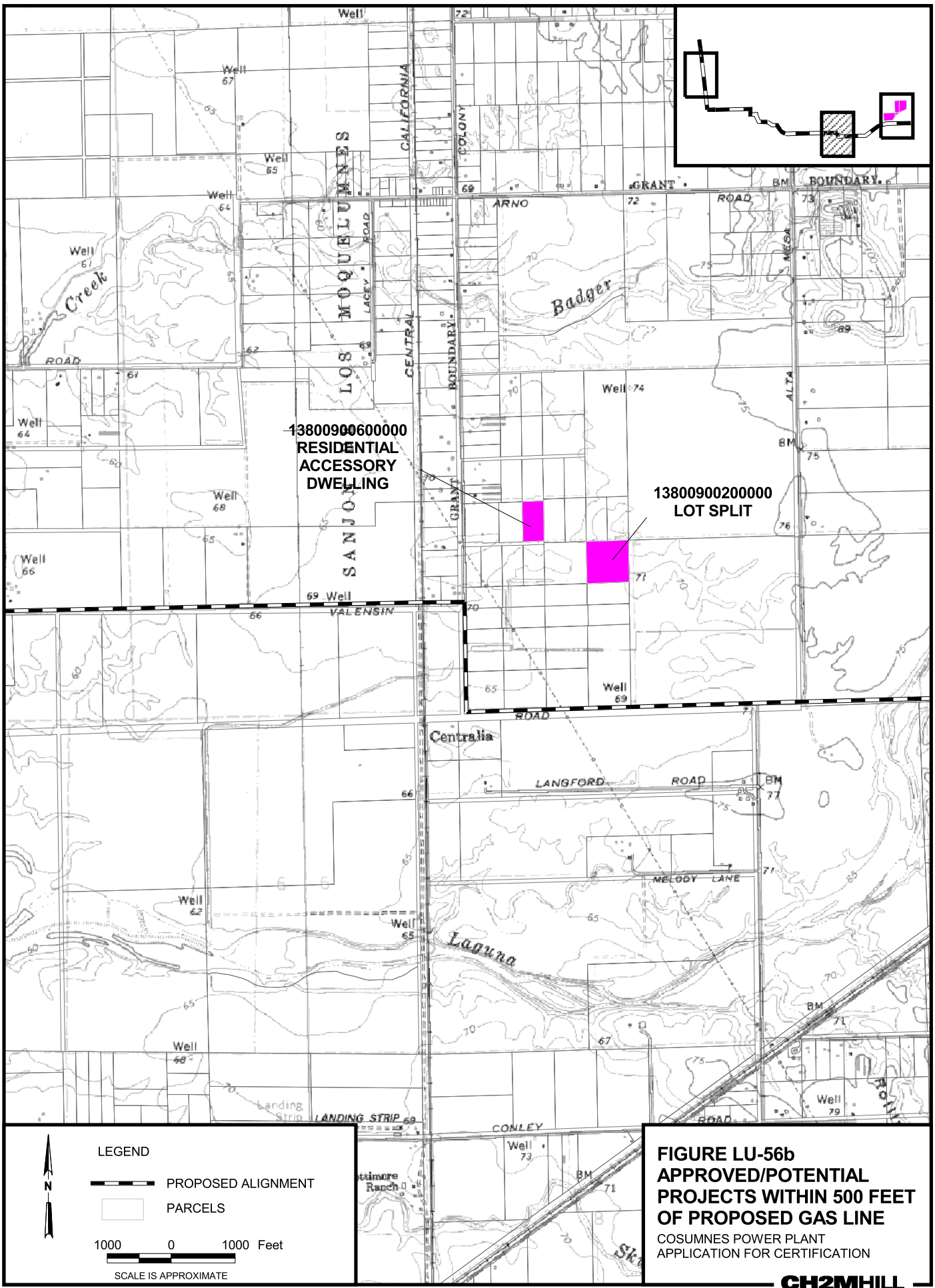

FIGURE LU-56b
APPROVED/POTENTIAL PROJECTS WITHIN 500 FEET OF PROPOSED GAS LINE
COSUMNES POWER PLANT
APPLICATION FOR CERTIFICATION

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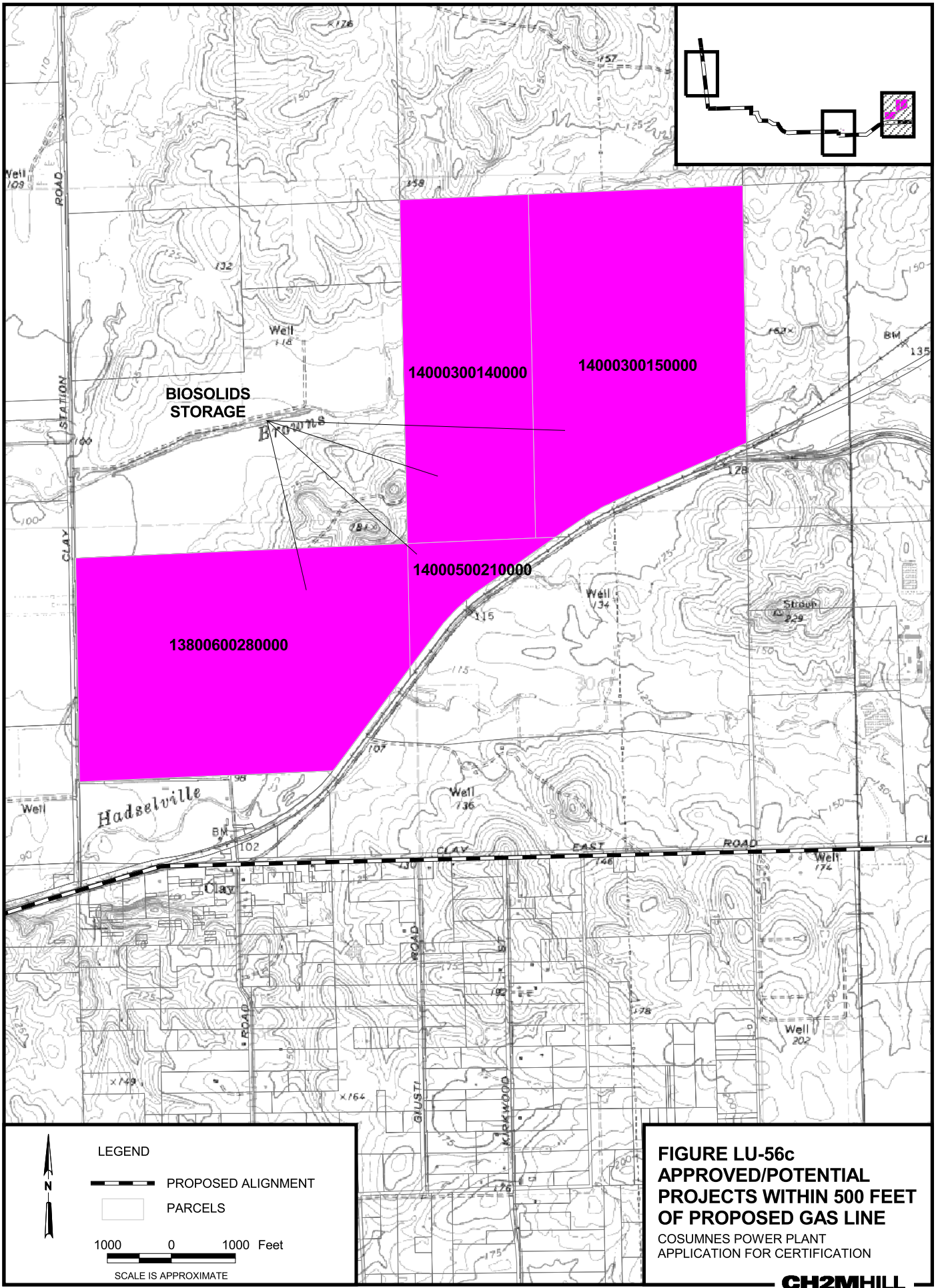

FIGURE LU-56c
APPROVED/POTENTIAL PROJECTS WITHIN 500 FEET OF PROPOSED GAS LINE
COSUMNES POWER PLANT
APPLICATION FOR CERTIFICATION

CH2MHILL

Technical Area: Visual Resources and Plumes
CEC Authors: Michael Clayton and William Walters
CPP Author: Wendy Haydon

BACKGROUND

Staff will need to make use of the Applicant's figures presented in the AFC and supplemental filings.

DATA REQUEST

87. Please provide three sets of electronic files on CDs of the following figures or their revisions: 1.1-2, 1.1-3, 1.1-4, 1.1-5, 2.2-2, 2.2-3, and all figures contained in the Visual Resources Section of the AFC.

    Response: Three CD-ROMS are being provided that contain the above-referenced figures. The CD contains the figures provided in AFC Supplement A that replace those previously provided in the AFC. Figure 2.2-3 has not been provided since the location of the laydown area has changed. A better figure to illustrate the proposed location is Figure 1 of the Phase 1 Site Assessment. That figure has been included in the CD-ROM.

88. Please provide three sets of electronic files on CDs of the revisions to existing figures and new figures as requested in the following Data Requests.

    Response: These files are provided in the three CD-ROMS.

Technical Area: Water and Soil Resources
CEC Authors: Philip Lowe, P.E., Greg Peterson, P.E., & Richard Latteri
CPP Author: EJ Koford

BACKGROUND

The AFC demonstrates through FEMA Federal Insurance Rate Maps that the CPP is not within the 100-year floodplain of Hadselville Creek (AFC Section 8.14.3.3). However, the absence of a FEMA-mapped floodplain does not necessarily mean a site is not subject to flooding. The CPP is adjacent to Clay Creek, which apparently has not been mapped by FEMA, and therefore has a 100-year floodplain of unknown extent. Several tributaries to Clay Creek cross the CPP site and the extent of flooding is also unknown. The AFC states and Figure 8.14-4R shows that several of these drainageways will be diverted around the CPP site but discharges and floodplains are not shown. Figure 8.14-4R shows a corner of the proposed detention basin very close to the creek bank where it could be subject to erosion from creek overbank flows.

DATA REQUEST

143. Please provide a hydrologic analysis to determine the estimated100-year peak discharge rates for Clay Creek and its tributaries adjacent to and upstream of the site.

    Response: A HEC analysis is being provided as Attachment W&SR-143.

144. Please provide a hydraulic analysis using the USACE HEC-RAS (or other appropriate methodology) to map the 100-year floodplain for Clay Creek and its tributaries at, adjacent to, and upstream of the site.

    Response: See Data Response #143.

145. Show existing and 100-year floodplains on Figure 8.14-4R, and provide conceptual design hydraulic calculations and typical sections for diversion channels.

    Response: See Data Response #143.

146. At locations where the 100-year floodplain would encroach on proposed site features, please demonstrate whether erosion or other protection is needed and provide conceptual plans and analysis as appropriate.

    Response: See Data Response #143.

Attachment W&SR-143

Introduction

CEC Staff requested additional analysis of the 100-year flood plain in the vicinity of the proposed CPP site. The FEMA maps for the region indicated the limits of the 100-year floodplain did not approach the site, but on review with FEMA staff, it was determined that Clay Creek, as a secondary tributary, had probably not been included in site-specific modeling.

A detailed site-specific flood mapping effort would require substantial time, cost and effort that is not practical within the plant certification schedule. Therefore, the Applicant and CEC Staff consulted to agree on a methodology that would provide a robust but conservative estimate of where the 100-year floodplain would be in a 100-year event. The attached technical memorandum reports the results in tabular and graphic form of site-specific HEC-RAS modeling, which uses regional estimates to predict flood water elevations. The modeling is conservative in many respects, and estimates the probably "worst case" event. For example, the regional curves used in the model are predictive for the Sierra hydrologic region, which includes areas with snowmelt runoff and substantial upstream contributions that are not relevant to the relatively small area of the Clay Creek watershed.

The result of this modeling indicate that under worst case conditions, the 100-year flood plain elevation at the east (upstream) end of the CPP would potentially be between 149 and 150 feet MSL. This would mean that the area between the two arms of Clay Creek would essentially all be under slightly less than 1 foot of water in the event of a 100-year flood. Velocity of flows would be very low, because the gradient of the watershed is relatively level in this spot.

Approximately 85 percent of the site is presently above the predicted 100-year flood elevation (the northeast corner is below the flood elevation). As noted in the AFC, the site would be leveled at an elevation of approximately 150 feet using primarily balanced "cut and fill" prior to construction. Therefore, after construction none of the site would be within the possible 100-year flood elevation. The final site elevation should be adjusted to be above the predicted 100-year floodplain according to County standards, and therefore, the elevation of the site may need to be raised slightly.

Also from this analysis it is evident that filling the northeast corner would remove a small area from the flood plain capacity of the watershed. Depending on determinations of the regulatory agencies it may be necessary to replace this capacity in some manner. This could be replaced by excavating an area in the watershed sufficient to capture the filled volume, or some similar means. It appears that sufficient area exists within the apparent floodplain where excavation could occur if this is desirable.

Finally, it would be important to determine if flood water would potentially erode, undermine, or over-run the banks of the proposed facility. As noted above, the low gradient and broad open flood plain in this area mean that velocities, even under 100-year flood conditions, are predicted to be low. Therefore, good engineering and erosion control (vegetation) on the slopes surrounding the facility can adequately protect the facility from being eroded, undermined, or over-run.

The technical report attached describes the methodology used to estimate the 100-year discharge and flood plain elevation, and describes in figures and tables the results of modeling. The Applicant is confident that potential impacts can be minimized to a level of non-significance using good engineering design.

Clay Creek 100-Year Discharge Analysis

PREPARED FOR: EJ Koford
John Carrier

PREPARED BY: Mark Tompkins
Jennifer Maio

DATE: March 7, 2002

Scope

The Sacramento Municipal Utility District (SMUD) has proposed a new power plant (Cosumnes Power Plant [CPP]) near Rancho Seco, near Clay East Road and Clay Creek. As part of the Application for Certification (AFC) process, the California Energy Commission (CEC) has requested that SMUD investigate the extent of the 100-year floodplain of Clay Creek in the project area. The scope of this Technical Memorandum is to estimate the 100-year peak discharge for Clay Creek at the proposed project site and to model the water surface profile for the 100-year discharge.

Purpose

This analysis was performed to identify the potential for flood risk associated with the 100-year discharge at the proposed project site.

Report Organization

This Technical Memorandum includes the following sections:

- 100-Year Discharge Estimation Methodology
- Water Surface Profile Analysis Methodology
- Water Surface Elevation Results
- Summary

100-Year Peak Discharge Estimation Methodology

The 100-year peak discharge for Clay Creek at the project site was estimated using the Waananen and Crippen regional curve method (1977). The Waananen and Crippen method separates the state of California into six hydrologic regions and uses regression equations generated for each region to determine peak runoff for a known drainage area and storm recurrence interval. The CPP is located in the Sierra hydrologic region, which extends east from the Sacramento and San Joaquin Rivers in the Central Valley to the Sierra divide. The peak discharge for a 100-year event in the Sierra hydrologic region is calculated by:

$$Q_{100} = 15.7 A^{0.77} P^{1.02} H^{-0.43}$$

where Q_{100} is the peak discharge for a recurrence interval of 100 years (cfs), A is the drainage area (square miles), P is the mean annual precipitation (inches), and H is the altitude index (thousands of feet). Because the regression equation for this region includes parameters for a wide range of watershed types, the peak discharge predicted by this method for a small Central Valley stream like Clay Creek is likely to be conservative.

The Clay Creek drainage basin upstream of the project site was delineated on the United States Geological Survey (USGS) Goose Creek Quadrangle. The drainage area was measured with a planimeter as 4.6 square miles. A map wheel was used to measure the basin length along the principal channel from the proposed project site to the drainage divide. The altitude index was determined by calculating the average of the principal channel's elevation at 10 percent and 85 percent of the basin length. The final basin length was calculated as 13,800 feet and the final altitude index was calculated as 190 feet. The basin relief of 120 feet was calculated as the difference between the elevation at the project site and the elevation at the drainage divide. The average annual rainfall of 16.72 inches for the basin was calculated as the mean of the total annual rainfall recorded at Clay Ranch from 1931 through 1980. Table 1 summarizes the input and results of the Waananen & Crippen Method.

TABLE 1

Waananen and Crippen Method Summary Table

Drainage Area (mi^2)	Precipitation (in)	Altitude Index (1000s of feet)	Discharge (cfs)
4.6	16.72	0.19	1837

Note – Because the Rancho Seco reservoir is not operated for flood control, the drainage area contributing to the reservoir was included in this calculation of the 100-year peak discharge.

The discharge estimate of 1837 cfs for the 4.6 square mile drainage area of Clay Creek at the project site is conservative and is probably the maximum potential 100-year discharge. Professional experience has shown that the 100-year discharge in similar rural basins in Northern California can typically be estimated as 100 to 200 cfs per square mile of watershed area. Therefore, using the 200 cfs per square mile estimate, the 100-year discharge in Clay Creek could be as low as 920 cfs. The 920 cfs and the 1837 cfs discharges were both used in the water surface profile modeling to show a potential range of 100-year flood conditions at the project site. However, if final site planning and design are based on water surface elevations below those predicted for the 1837 cfs discharge, more detailed hydrologic modeling should be performed to refine the 100-year discharge estimate within the identified range.

Water Surface Profile Analysis Methodology

The Hydrologic Engineering Center–River Analysis System (HEC-RAS) model was used to determine the 100-year water surface elevations in Clay Creek near the proposed project site. Two types of information are required to perform a HEC-RAS analysis:

- Channel geometry and roughness
- Boundary stage/discharge conditions

Channel Geometry and Roughness

The existing digital terrain model (DTM) for the project site and transects surveyed outside the area covered by the DTM were used to create the channel and floodplain geometry in the HEC-RAS model. The boundaries of the model are Clay East Road to the south, the existing power plant levee to the north, just downstream of the access road culvert to the west, and just upstream of the abandoned mining dam to the east. The model does not include the flow dynamics in areas upstream or downstream of these boundaries. Model cross sections were spaced approximately every 250 feet along Clay Creek within the identified boundaries.

Manning's *n* values for the channel and overbank roughness of each cross section were selected based on guidance in Chow (1959). An *n* value of 0.05 (maximum for clean and winding channels with some weeds and stones) was selected for the primary Clay Creek channel. An *n* value of 0.07 (maximum for floodplains with scattered brush and heavy weeds) was selected for the right overbank area (the area to the right of Clay Creek when looking downstream). An *n* value of 0.06 was selected for the left overbank area because the left overbank contained both a floodplain and a secondary channel, and should therefore convey flow more efficiently than the right overbank area. These *n* values will produce conservative (i.e. higher) water surface elevation estimates because they are the maximum (i.e. roughest) values in the ranges of roughness attributed to each condition.

Boundary Stage / Discharge Conditions

The normal depth calculated for the downstream cross section was used as the boundary water surface elevation condition in this model. Normal depth is the depth that occurs when flow is uniform.

MODEL ASSUMPTIONS

Several assumptions were made in the development of the HEC-RAS model used in this analysis. The assumptions are listed below:

- The 100-year discharge flows at normal depth in the vicinity of the project site.
- The existing digital terrain model accurately represents the current geometry of Clay Creek and the topography of the project area.
- The geometry of Clay Creek and the topography of the project area do not change significantly during the 100-year discharge.
- The channel and floodplain roughness do not increase or decrease significantly during the 100-year discharge.
- The culvert at the access road is not blocked during the 100-year discharge.

MODEL CONSTRUCTION

The geometry and roughness data and the boundary condition data were input to the HEC-RAS model to represent the conditions at the project location. Figure 1 is a graphical representation of the conditions at the project reach as modeled in HEC-RAS. The model was constructed to best represent the expected flow path of the 100-year

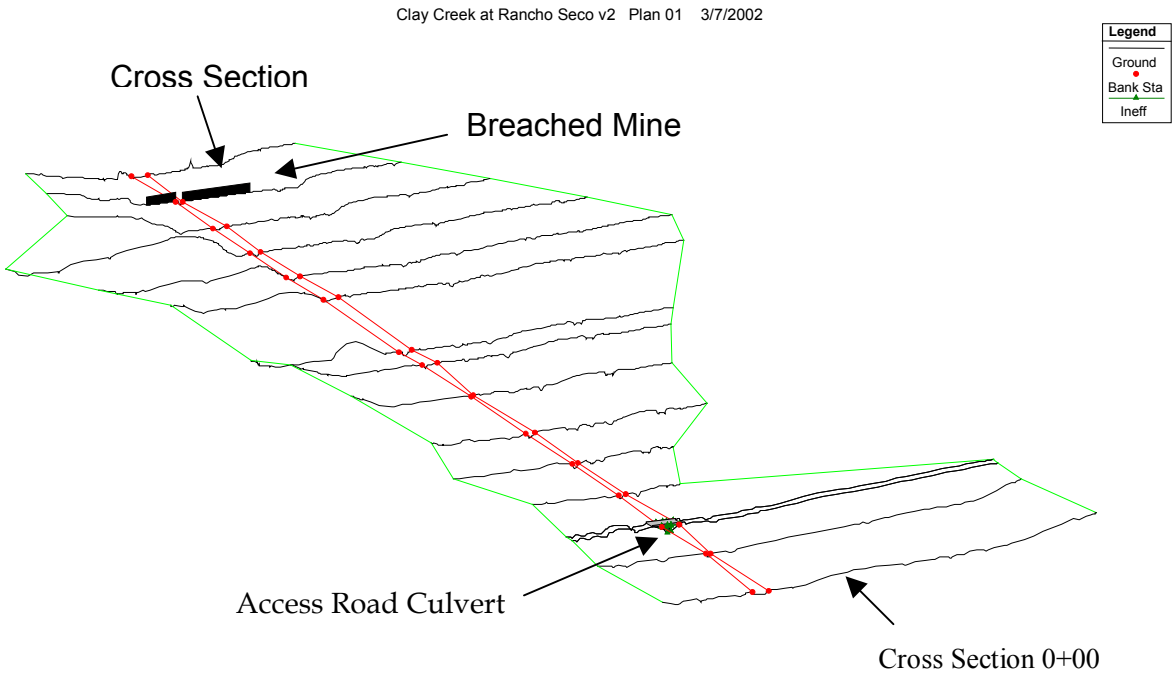

Figure 1: Graphical Depiction of the Clay Creek HEC-RAS Model

discharge. Given the nature of the site, it was assumed that the 100-year discharge would split into two channels upstream of the breached mine dam and then flow in both channels and across the floodplain between the two channels down to the access road culvert at the downstream end of the site. To capture this behavior, the breached mine dam was modeled as a blocked obstruction that forces water to flow around it when the flow capacity of the breach is exhausted. The culvert was modeled as a

culvert that allowed water to flow around and over the road in addition to flowing through the culvert.

Water Surface Elevation Results

Water surface elevations were calculated for the 100-year peak discharges of 1837 cfs and 920 cfs. Table 2 summarizes the 100-year peak discharge water surface elevations calculated by the HEC-RAS model.

TABLE 2
Clay Creek 100-Year Peak Discharge Water Surface Elevations

Cross Section Station	Cross Section Location Description	1837 cfs Water Surface Elevation (feet msl)	920 cfs Water Surface Elevation (feet msl)
00+00	Approximately 625 feet downstream of culvert at access road.	135.83	135.03
03+67	Approximately 258 feet downstream of culvert at access road.	137.99	137.25
06+25	Immediately downstream of culvert at access road.	139.06	138.23
09+38	Between culvert at access road and breached mine dam.	140.71	139.84
12+40	Between culvert at access road and breached mine dam.	142.23	141.63
15+37	Between culvert at access road and breached mine dam.	142.88	142.21
19+07	Between culvert at access road and breached mine dam.	143.93	143.01
22+14	Between culvert at access road and breached mine dam.	145.37	144.82
23+38	Between culvert at access road and breached mine dam.	145.71	145.16
28+61	Between culvert at access road and breached mine dam.	147.40	146.79
30+69	Between culvert at access road and breached mine dam.	147.99	147.40
33+11	Between culvert at access road and breached mine dam.	149.07	148.43
35+58	Between culvert at access road and breached mine dam.	150.04	149.4
38+11	At breached mine dam.	151.35	150.66
40+73	Upstream of breached mine dam.	152.14	151.40

Summary

This analysis used commonly applied hydrologic and hydraulic methods to estimate the water surface elevations at the proposed project site for the 100-year discharge.

Conservative assumptions were made throughout the analysis in order to calculate water surface elevations that will not likely be exceeded in a 100-year discharge event. The conservative assumptions included the use of a highly general regional discharge curve, the selection of maximum Manning's roughness values, and the exclusion of Rancho Seco Reservoir as a flood attenuating facility. It is important to note that this analysis identified a range of potential 100-year discharge values, and that more detailed hydrologic modeling should be performed if the proposed project design will be based on conditions associated with a 100-year discharge that is less than the maximum value (1837 cfs) calculated in this analysis.

References

Chow, Ven Te. 1959. Open Channel Flow. McGraw Hill.

Rantz, S.E. 1971. Suggested criteria for hydrologic design of storm-drainage facilities in the San Francisco Bay region, California. US Geological Survey Open-File Report, Menlo Park, California.

U.S. Army Corps of Engineers, Hydrologic Engineering Center. 2001. HEC-RAS River Analysis System Users Manual, Version 3.0.

Waananen, A.O., and J.R. Crippen. 1977. Magnitude and frequency of floods in California. US Geological Survey Water-Resources Investigations 77-21.